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# Engineering Design File

FOR

# Storage Module Utilization Evaluation

Prepared for:
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Idaho Operations Office
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Idaho National Engineering and Environmental Laboratory

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# ENGINEERING DESIGN FILE



1. Project File No. RWMC-EDF-1031 2. Project/Task 3,100 m$^3$ Project

3. Subtask Transuranic Waste Storage Area

4. Title: Storage Module Utilization Evaluation

5. Summary:

This Engineering Design File (EDF) evaluates the demand for storage modules based on operational and project-specific requirements. Its purpose is to examine the approach for storage module utilization that meets the current Life Cycle Baseline Environmental Management (EM) Program needs through calendar year 2002.

Additionally, planning beyond 2002 for remote-handled (RH) transuranic (TRU) waste is considered. This includes the Waste Generator Services (WGS) and environmental restoration (ER) program needs. This evaluation seeks to meet the spirit and letter of the Tri-Party Memorandum of Agreement (Ref. 5) between British Nuclear Fuels, Ltd. (BNFL, Inc.), the Department of Energy (DOE), and Bechtel BWXT Idaho, Inc (BBWI).

The TRU Waste Project at the Radioactive Waste Management Complex (RWMC) currently manages one Type I (Waste Management Facility [WMF]-635), and six Type II storage modules (WMF-628 through -633). One storage module (WMF-634) was turned over to BNFL in June 1999.

These storage modules, designed and permitted under Resource Conservation and Recovery Act (RCRA) Part B guidelines, are employed in the management of mixed TRU waste containers. Currently, a majority of the space is used (Ref. 1) to store, characterize, and process TRU waste in response to the "Settlement Agreement Milestone." The Settlement Agreement Milestone specifies that the 3,100 m$^3$ of TRU waste will be shipped out of Idaho to the Waste Isolation Pilot Plant (WIPP) by December 2002. (Ref. 2)

After December 2002, WMF-628 will be needed to continue to safely store and characterize RH TRU waste Suspect RH-TRU waste, RH U-233 waste, and waste that may be rejected by BNFL that does not meet the Waste Acceptance Criteria of the Advanced Mixed Waste Treatment Facility (AMWTF). The future revisions of this EDF will also address storage needs for the ER program and WGS once final storage requirements are established.

This evaluation shows, at present, one Type I and six Type II modules are needed to support safe and compliant waste storage and provide the necessary space for operational needs supporting characterization activities and transport of 3,100 m$^3$ of TRU waste to meet the Settlement Agreement Milestone.

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# CONTENTS



# FIGURES

# ACRONYMS

| | |
|---|---|
| AMWTF | Advanced Mixed Waste Treatment Facility |
| AMWTP | Advanced Mixed Waste Treatment Project |
| BBWI | Bechtel BWXT Idaho, Inc. |
| BNFL | British Nuclear Fuels, Ltd. |
| CCA | Criticality Control Area |
| CH | contact handled |
| DOE | Department of Energy |
| DWP | Detailed Work Plan |
| EDF | Engineering Design File |
| EM | Environmental Management |
| ER | Environmental Restoration |
| FRP | Fiberglass Reinforced Plywood |
| HVAC | heating, ventilating, and air conditioning |
| IDC | item description code |
| ILTSF | Intermediate-Level Transuranic Storage Facility |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| INTEC | Idaho Nuclear Technology and Engineering Center |
| LCB | Life Cycle Baseline |
| LL | low-level |
| MLLW | Mixed Low-Level Waste |
| NDA | nondestructive assay |
| NDE | nondestructive examination |
| RH | remote handled |
| RCRA | Resource Conservation and Recovery Act |
| RSSC | Radioactive Shielded Storage Containers |
| RWMC | Radioactive Waste Management Complex |

| | |
|---|---|
| SWB | standard waste box |
| SWEPP | Stored Waste Examination Pilot Plan |
| TSCA | Toxic Substances Control Act |
| TRIPS | Transuranic Reporting, Inventory, and Processing System |
| TRU | transuranic |
| TRUPACT | transuranic package container |
| VOCPD | Vented Overpack Cylindrical Painted Drum |
| WAC | waste acceptance criteria |
| WAG | waste area group |
| WGS | Waste Generator Services |
| WIPP | Waste Isolation Pilot Plan |
| WMF | Waste Management Facility |

# 1. INTRODUCTION

This EDF evaluates the storage modules utilization, operations, project-specific requirements, existing commitments, and projected future needs. This revision incorporates information from the recently revised EM Life-Cycle Baseline (LCB) (Ref. 10), which contains the Detailed Work Plan (DWP). The LCB now projects with ample detail all the activities necessary for the RWMC operations to support the 3,100 $m^3$ Project. The LCB has further details for post 3,100 $m^3$ Project requirements through FY 2020.

New to this revision is the space requirement for the remote-handled (RH) waste storage project and waste rejected by BNFL that does meet the Advanced Mixed Waste Treatment Facility (AMWTF) Waste Acceptance Criteria.

Space requirements for other EM programs (for example, ER and WGS) is preliminary. However, space utilization requirements will be evaluated in detail once more information becomes available.

# 2. STORAGE MODULE EVALUATION FROM NOW THROUGH DECEMBER 31, 2002

The storage modules are currently being used for storage of transuranic waste in accordance with RWMC Resource Conservation and Recovery Act (RCRA) Part B permit and for characterization and certification on activities being performed by 3,100 $m^3$ Project. The 3,100 $m^3$ Project will be completed December 31, 2002.

The Waste Isolation Pilot Plant (WIPP) opened for TRU waste disposal in FY 1999, and INEEL initiated waste shipments to WIPP in April 1999. Current status is as follows:

A. As of August 24, 2001, a total of 733.8 $m^3$ has been shipped to WIPP.

B. One Type II storage module (WMF-634) has been turned over to BNFL, Inc. This transfer was accomplished on June 14, 1999.

C. Initially, BNFL, Inc. planned to modify the southeast corner of WMF-635 (Type I module) to accommodate waste characterization activities. This required that the southeast corner of WMF-635 be made available to BNFL, Inc. before January 1, 2003. The revised AMWTP plan indicates permanent modifications to WMF-634 will be made to covert the building from a storage module to a waste characterization facility. With the revised AMWTP plan, a need no longer exists to transfer the southeast corner of WMF-635 before January 1, 2003 (Ref. 5).

D. On January 1, 2003, under contractual agreement, BNFL will take possession of the Type I module and five of the Type II modules (Ref. 5). One Type II module (WMF-628) will be retained by BBWI. Department of Energy contract No. ED-AC07-97ID13481 (Ref. 6) which states that transfer of storage modules will be accomplished during retrieval or operational activities. In either case, BNFL should request custody at least six months prior to occupancy. Negotiations may need to be initiated on a building by building basis for turnover (Ref. 5).

## 2.1 Storage Needs for Facility Operations/Characterization for 3,100 $m^3$ Project

The Settlement Agreement Milestone to move 3,100 $m^3$ TRU waste from Idaho to the WIPP facility in Carlsbad, New Mexico, has a due date of December 31, 2002. To support this milestone, and to store the TRU waste in accordance with RCRA Part B Permit, the six Type II storage modules and one Type I module have been used. Described below is the recent module usage in the near past and projected need through December 2002.

The DWP for the 3,100 $m^3$ Project, developed by BBWI (Ref. 10) includes a non-funded back-up plan to use mobile vendors to augment characterization activities. Utility upgrades to WMF-628 to accommodate mobile vendors will be completed in FY 2001. Current plans indicate that mobile vendors will be mobilizing in the early part of FY 2002.

Storage Space Needs:

### 2.1.1 Case 1: Mobile Vendors Not Deployed

A. Continued storage of all TRU waste until storage modules including remaining waste is turned over to BNFL. (This includes the inventory planned to be processed for disposal at WIPP. Storage space needed – 5.12 modules [see Appendix C, Section 2.1]).

B. WMF-628 currently stores approximately 1,371 containers of waste (see Appendix A, dated 08/27/01). The containers include waste with high fissile loading, shielded RH drums, shielded boxes for $233_U$ waste, suspect waste, and boxed waste from Mound. Some waste containers stored in WMF-628 require additional spacing between drums and cannot be stacked either due to weight limitation or fissile content. Storage space utilized – 0.93 Module (see Appendix C, Section C.2.1).

C. The transuranic package transport (TRUPACT) II Payload Staging area in WMF-635 will be required for "Operational Needs" to stage payload canisters awaiting WIPP Shipment authorization. This module is not used for general storage purposes.

D. Additional staging for pre-packaged shipments (26 each 55-gal drums per shipment), in WMF-628 and WMF-629 will be used by the 3,100 $m^3$ Project. Space needed for staging in WMF-628 and WMF-629 – 1.0 modules (Ref. 13 and 22).

E. Modules 630 through 633 are used for storage of TRU waste containers.

F. No new significant newly generated TRU waste streams are planned to be accepted at RWMC before December 31, 2002, therefore no evaluation for storage space needs to be performed for newly generated TRU waste.

G. No evaluation for consolidation of any INEEL stored MLLW needs to be considered for storage in WMF-628 in this revision of this EDF due to lack of information (Ref. 14).

H. According to National TRU Waste Management Plan (Ref. 7), a centralized characterization facility at WIPP is being planned which will eliminate the need for shipping TRU waste from small quantity generator sites to another DOE site (for example, INEEL) for characterization purposes. Based on this, it is assumed that no off-site contact handled (CH) or RH waste will be received and stored at RWMC from now until December 31, 2002.

Total storage space required for Operations, as well as 3,100 $m^3$ Project needs is approximately 5.12 modules for 27,302 containers of present inventory of waste, if mobile vendor is not deployed (see Appendix C, Section C.2.1). Early turnover of storage space to AMWTF cannot be estimated due to WIPP shipment delays beyond 3,100 $m^3$ Project control.

### 2.1.2 Case 2: Mobile Vendors Deployed

WMF-628 has been modified to accommodate mobile vendors. If mobile vendors are deployed, they will use the storage building for characterization and storing feedstock drums. Additional space required for mobile vendors and staging of inventory to be characterized by the mobile vendor is 0.25 modules (see Appendix A and Ref. 11).

Total storage space needed through December 31, 2002 if mobile vendors are deployed is 5.37 modules (base case + space needed for mobile vendors and staging of inventory).

# 3. STORAGE MODULE UTILIZATION EVALUATION BEYOND DECEMBER 31, 2002

After December 31, 2002, only one storage module will be retained by BBWI to manage the RH waste as well as any waste rejected by BNFL that does not meet the AMWTF WAC.

The 1995 Settlement Agreement between the State of Idaho, DOE, AND Department of Navy specifies that all TRU waste be shipped to the WIPP or other such facility designated by DOE by target date of December 31, 2015, and in no event later than December 31, 2018.

The activities required to support the eventual characterization and disposal of RH TRU, as well as waste that will not be processed by AMWTF, are detailed in the DWP (Ref. 19) and Life Cycle Plan for TRU Waste Project (Ref. 20).

Other Environment Management activities that may need storage space in the WMF-628 include, the ER project and WGS.

## 3.1 Storage Needs for Transuranic Technical Integration Project

This project provides capabilities to achieve disposal of stored RH TRU, as well as waste that may be rejected by BNFL. The RH TRU waste will be retrieved, overpacked in shielded containers for storage and characterization prior to either direct shipment to WIPP or repackaging at Idaho Nuclear Technology and Engineering Center (INTEC). The project also provides for receipt, storage and disposition of suspect RH TRU and U-233 waste that may be received from BNFL. To achieve this, WMF-628 is planned to be modified for characterization activities in accordance with WIPP requirements.

A. The RH TRU Waste Disposition Project assumes that half of storage module WMF-628 will be converted to characterization unit operations; that is, modify the facility to install a new wall and provide environmental controls (heating, ventilating, and air conditioning [HVAC]). Storage space needed is 0.5 modules (Ref. 18).

B. According to the planning forecast (Ref. 16), RH TRU waste will be retrieved and transported to INTEC for processing ranges from 25 containers in FY 2002, requiring approximately 0.03 modules of storage area, to a projected maximum of 675 containers, requiring approximately 0.44 modules for storage area in FY 2009 (Ref. 15). These storage areas are based upon an assumption that the containers require a storage area equivalent to that of boxes and are stored to four levels high. Maximum storage space needed – 0.44 modules at any time (see Appendix C, Section C.4). Total characterization needs (0.5 module) is 0.94 module.

C. The evaluation of the stored inventory determined that AMWTF may not be able to treat approximately 432 $m^3$ of waste (Ref. 16). This includes 73 $m^3$ of U-233 non-irradiated fuel waste, 52 $m^3$ of RH-U233 waste, 220 $m^3$ of suspect RH waste received from Rocky Flats and 87 $m^3$ of high fissile waste. This, when combined with the RH-TRU inventory of 84 $m^3$, brings total AMWTF reject waste to 516 $m^3$. Additionally, there exists 42 $m^3$ of non-defense generated waste, which will be processed by AMWTF, but does not have a disposal path. Thus, a total volume of 558 $m^3$ (516 $m^3$ + 42 $m^3$) of waste (2,899 containers) is assumed to be stored. If, for any reason, all the waste is received, and if no path-forward is available, the total storage space need will exceed WMF-628 capacity. The total storage space needed is 3.54 modules (see Appendix C, Section C.4). When combined with 0.5 module needed for characterization, the maximum space requirement is 4.04 modules.

## 3.2 Potential Storage Needs for Other Environmental Management Activities

A. ER activities for WAG-7 or Pit-9 will not need significant storage space per current plans. (Ref. 12) Negotiations are continuing with regulatory agencies. Storage space for cores extracted from buried TRU waste, if taken during the next three years, may be necessary; however, this seems unlikely.

Estimation for FY-2007 is approximately 1,000 each 55-gal drums of retrieved mixed low-level (LL)/TRU waste and interstitial soil. All waste retrieved after December 31, 2002 will be transferred to BNFL for characterization, storage, and disposal. (Ref. 12) Maximum space forecast for possible retrieved mixed LL/TRU waste is approximately 838 sq ft or 0.08 modules.

B. Consolidation of MLLW could be considered for storage in WMF-628, as defined for High Radiation/Fissile, CH, RH, or MLLW (Ref. 14) after FY 2002. Detailed information to perform storage estimate was not available.

C. According to the National TRU Waste Management Plan (Ref. 7), a centralized characterization facility at WIPP is being planned. This facility will eliminate the need for shipping TRU waste from small quantity generator sites to another DOE site (for example, INEEL) for characterization purposes. Based on this, it is assumed that no off-site CH or RH waste will be received and stored at RWMC from now until December 31, 2002.

# 4. SUMMARY

The evaluation shows that the current storage and 3,100 $m^3$ Project operations require all six Type II storage modules even if the mobile vendor's option is not exercised. However, the storage capacity may exceed the demand in the near future (after FY 2003) if a path forward is not available for high fissile, U-233 rods and pellets, and non-defense TRU waste rejected by BNFL.

# APPENDIX A

## TRIPS Report 08/27/01

## Building Container Count

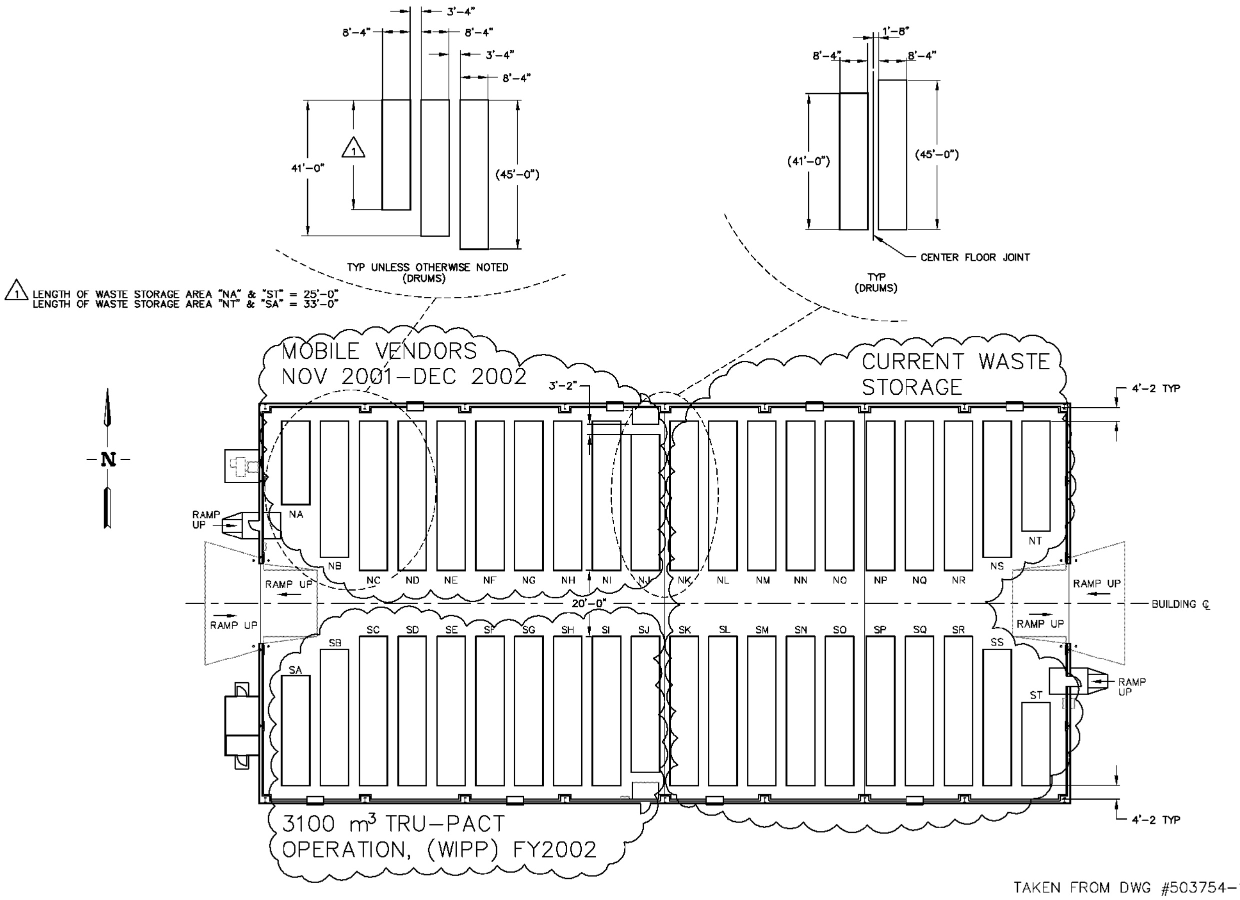
Total Waste Containers: 28940

| Number | Name | | Container Type | Container Count |
|---|---|---|---|---|
| 610 | SWEPP Building | 001 | drum, 55 Gallon (17C) | 170 |
| | | A | drum, 55 Gallon Drum (17H) | 5 |
| 615 | SWEPP Drum Vent System Building | 001 | drum, 55 Gallon (17C) | 2 |
| | | A | drum, 55 Gallon Drum (17H) | 13 |
| 618 | TRU-Pack II Loading Station | 001 | drum, 55 Gallon (17C) | 83 |
| 628 | Type 2 Storage Module #1 (East of 612) | 001 | drum, 55 Gallon (17C) | 1281 |
| | | 007 | box, M-III, M-IV bin | 4 |
| | | 009 | box, SAND Type-1 | 1 |
| | | A | drum, 55 Gallon Drum (17H) | 13 |
| | | C | drum, 83 Gallon | 34 |
| | | CCS | drum, Vented Overpack Cylindrical Painted | 11 |
| | | MSC | box, Shielded Rectangular (MSC) | 12 |
| | | NS4 | box, Mexican Americium TX4 | 4 |
| | | RSS | Radioactive Shielded Storage Container | 10 |
| | | TXB | box, TX-4 Oversize steel | 1 |
| 629 | Type 2 Storage Module #2 (East of 612) | 001 | drum, 55 Gallon (17C) | 1612 |
| | | 010 | Standard Waste Box | 42 |
| | | 325 | drum, 55 Gallon (UN1A2/X325/S), | 1 |
| | | 395 | drum, 55 Gallon (UN1A2/X395), | 35 |
| | | 400 | drum, 55 Gallon (UN1A2/X400/S), | 2 |
| | | 425 | drum, 55 Gallon (UN1A2/X425/S), | 3 |
| | | 427 | drum, 55 Gallon | 18 |
| | | A | drum, 55 Gallon Drum (17H) | 10 |
| | | C | drum, 83 Gallon | 164 |
| | | UN1 | drum, 55 Gallon (UN1A2) | 20 |
| 630 | Type 2 Storage Module #3 | 001 | drum, 55 Gallon (17C) | 4072 |
| | | A | drum, 55 Gallon Drum (17H) | 4149 |
| 631 | Type 2 Storage Module #4 | 001 | drum, 55 Gallon (17C) | 3983 |
| | | 008 | box, SAND Type-2 | 137 |
| | | A | drum, 55 Gallon Drum (17H) | 3532 |
| | | C | drum, 83 Gallon | 881 |
| 632 | Type 2 Storage Module #5 | 001 | drum, 55 Gallon (17C) | 380 |
| | | 002 | box, 6 Drum Overpack | 16 |
| | | 004 | box, FRP Overpack | 15 |
| | | 008 | box, SAND Type-2 | 306 |
| | | 009 | box, SAND Type-1 | 11 |
| | | 320 | drum, 55 Gallon (UN1A2/X320/S), | 4 |
| | | 425 | drum, 55 Gallon (UN1A2/X425/S), | 1 |
| | | 55U | drum, 55 Gallon unmarked and non-DOT | 3 |
| | | 83U | drum, 83 Gallon unmarked and non-DOT | 13 |
| | | A | drum, 55 Gallon Drum (17H) | 511 |
| | | C | drum, 83 Gallon | 2778 |
| | | CBX | Cakebox | 219 |
| | | E | box, Fiberglass Reinforced Plywood (FRP) | 116 |
| | | TXA | box, TX-4 Standard steel | 23 |
| | | TXB | box, TX-4 Oversize steel | 77 |
| 633 | Type 2 Storage Module #6 | 001 | drum, 55 Gallon (17C) | 1629 |
| | | 008 | box, SAND Type-2 | 747 |
| | | 55U | drum, 55 Gallon unmarked and non-DOT | 2 |
| | | A | drum, 55 Gallon Drum (17H) | 102 |
| | | C | drum, 83 Gallon | 1 |
| | | CBX | Cakebox | 39 |
| | | F | bin, 120 cubic foot (M-III, M-IV) | 50 |
| | | TXB | box, TX-4 Oversize steel | 227 |
| 635 | Type 1 Storage Module | 001 | drum, 55 Gallon (17C) | 970 |
| | | 010 | Standard Waste Box | 3 |
| | | A | drum, 55 Gallon Drum (17H) | 217 |
| | | C | drum, 83 Gallon | 3 |
| 636 | Transuranic Storage Area - Retrieval (TSA-RE) | A | drum, 55 Gallon Drum (17H) | 4 |
| | | C | drum, 83 Gallon | 1 |
| 637 | RWMC Shipping/Receiving Area | 001 | drum, 55 Gallon (17C) | 5 |
| | | 395 | drum, 55 Gallon (UN1A2/X395), | 1 |

| | | | | |
|---|---|---|---|---|
| | | CCS | drum, Vented Overpack Cylindrical Painted | 4 |
| UNK | unknown | 001 | drum, 55 Gallon (17C) | 2 |
| | In-transit Containers | 001 | drum, 55 Gallon (17C) | 150 |
| | | 55U | drum, 55 Gallon unmarked and non-DOT | 1 |
| | | A | drum, 55 Gallon Drum (17H) | 1 |
| | Lost Containers | 001 | drum, 55 Gallon (17C) | 1 |
| | | A | drum, 55 Gallon Drum (17H) | 2 |

**APPENDIX B**

# Space Utilization for WMF-628



# APPENDIX C

## C.1 Total Stored Inventory and Associated Regulatory and Operational Requirement for Safe Storage

**Summary of Stored Waste Containers for Buildings WMF-628, 629, 630, 631, 632, and 633:**

*Data obtained from Transuranic Reporting, Inventory, and Reporting Process System (TRIPS), "Building Container Count", August 27, 2001(Appendix A)*

| Container Type | Number of Containers |
|---|---|
| 55-gal drums | 21,363 |
| 83-gal drums | 3,871 |
| RSSC | 10 |
| Vented Overpack Cylindrical Painted Drum | 11 |
| Box, M-III, M-IV Bin | 4 |
| Bin, 120 cubic feet, (M-III, M-IV) | 50 |
| Box, SAND Type 1 | 12 |
| Box, SAND Type 2 | 1,190 |
| Box, FRP | 116 |
| Box, FRP Overpack | 15 |
| Box, 6 drum Overpack | 16 |
| Box, Shielded Rectangular | 12 |
| Box, Mexican Americium | 4 |
| Box, TX-4 Standard steel | 23 |
| Box, TX-4 Oversize steel | 305 |
| Cakebox | 258 |
| SWBs | 42 |
| **Total Containers** | **27,302** |

For calculation purposes, the storage requirements are computed based upon the following categories derived from the above summary:

- 55-gal drums (see Figure 10)
- 83-gal drums (including consideration of the RSSC's) (see Figures 2 and 11)
- Vented Overpack Cylindrical Painted Drums (see Figure 4)
- M-III, M-IV Bins and the 120 cubic feet Bins (M-III, M-IV) (see Figures 14 and 16)
- Mexican Americium Boxes (see Figure 6)
- Shielded Rectangular Boxes (see Figure 5)
- SWBs (see Figure 9)

- The remaining boxes (SAND Types 1 and 2, FRP, FRP Overpack, 6 drum overpacks,TX-4 Standard and Oversize steel, and Cakeboxes) are lumped together as a quantity of 1,935 boxes. (See Figures 12, 13, and 15.)

Theoretical Minimum (Dense-Packed Storage): Theoretically, the minimum space requirement for the containers in the table above is essentially **four Modules**, if we assume all waste containers are placed in storage configurations complying solely with the *mechanical* restrictions[1] in the "Management Plan for Waste Configuration and Segregation in WMF-610, and -628 through -635." (Ref. 8) This hypothetical approach is for reference only, as it ignores segregation (regulatory/radiological/safety) and separation (operational) requirements, as well as the reduction in stacking efficiency resulting from the variability in boxes (that is, a half-dozen or more, different geometries). However, the 27,302 containers in the table would, under these idealized conditions, completely fill three Type II Modules, with the remaining containers taking about 50% of the fourth Module (see pages C-8 through C-14 for calculations).[2] The theoretical minimum space (that is, maximum "dense pack") could be approximated, however, provided that:

1. All containers making up at least half of a Module storage space have the same geometry and are physically compatible (for example, all 55-gal drums, with no overweight containers and no overpacks (all boxes making up a row are the same size);

2. All wastes in any given row were compatible (for example, space is not wasted by storing partial rows of containers with either "unknown" contents or incompatible wastes);

3. All waste containers in a given row are destined for the same process (in other words, the containers at the front of the row are as "usable" for the intended process as the ones at the back of the row);

4. All containers are free of issues associated with the storage/handling of radioactive material (for example, radiation-field exposure problems, no high-fissile containers);

5. No "maneuvering room" is required to perform operations in the building (that is, any container removed from the stack is removed from the building and does not require set-down space).

Achieving these five conditions would seem almost impossible. However, waste containers destined for treatment (all boxes except the WIPP SWBs plus those drums that fail the certification processes) can be concentrated in a manner approaching the maximum dense pack.

Segregation (Regulatory and Safety Compliance): Segregation of certain wastes is required by safety and regulatory demands, increasing the minimum space to five Type II Modules. The requirements are derived from three principal sources:

1. As noted in Ref. 8, mixed wastes must be segregated into four hazardous waste categories:

   A. wastes regulated under the Toxic Substances Control Act (TSCA)

   B. RCRA-defined incompatible wastes

   C. containers with unknown contents (referred to as "unknowns")

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[1] Each building must have a 20-ft center aisle, 3-ft lateral and peripheral aisles, and must not have waste stacked closer than 6 ft to the outer skin of the building; drums can be stacked up to 4 wide, 5 high, and 22 long; boxes can be stacked up to 4 wide, 4 high, and 11 long (Volume 5, Attachment 1.B, Page 57, Reference 4).

[2] It should be noted that this hypothetical scenario would, most likely, result in Notices of Violation, with the potential for commensurate fines and penalties.

D. the general population.

Accordingly, the waste containers must be placed in segregated storage areas corresponding to these categories.

2. Criticality Control Area (CCA) and radiological safety requirements (Ref. 9 & Ref. 21) impose restrictions on waste container placement.[3]

3. Although not truly a "segregation" issue, personnel- and facility-safety mandates (Ref. 8) impose "safe-stacking" limitations to preclude accidents. Examples include seismic requirements, container- and floor-loading limitations, fire-protection system clearances, and height limits on freestanding "column" configurations.

   During removal and restorage of wastes from the Air-Support Weather Shields, the waste containers were segregated in compliance with all preceding requirements, resulting in the distribution of wastes in Type II Modules.

4. Arranging containers meeting Drum Age Criteria and those requiring venting.

Separation (Operational Utility): Finally, operational needs drive the space requirements from five to six Type II Modules, at least for the near term. The flow of waste into and out of stacks and buildings (that is, its identifiability, accessibility and retrievability) plays a significant role *both* for certification and transportation of untreated waste to WIPP. Three forms of separation must be considered when arranging containers.[4]

1. ***Container type*** (that is, 55-gal drums, 83-gal overpacks, WIPP SWBs, or the 6+ types of boxes) optimizes use of the available storage space. This type of separation has been intrinsic in the operations to date, either because of safety-related restrictions (discussed above), or for purely programmatic reasons.

2. ***Waste type*** (that is, graphite, glass, organic setups, leaded rubber, salts, combustibles, cemented resins, and so forth) support considerations for operational feedstock. Thus, it increases the efficiency of both the certification and treatment processes.

3. ***Waste/container disposition*** [that is, scheduled for nondestructive examination (NDE)/nondestructive assay (NDA) or intrusive examination, WIPP disposal, "future consideration," or treatment in the AMWTP] primarily supports certification and shipment of untreated waste. However, it allows space to be freed up as wastes are shipped, and non-shippable wastes are placed in consolidated storage.

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[3] The 12 waste containers with individual fissile values >380 grams, which cannot be stacked and must be overpacked and stored on 6-ft centers; 169 drums of $233_U$ wastes, placed in shielding boxes, which can be spaced (more or less) as usual but cannot be stacked; and 25 RH drums in shielded overpacks. These three cases alone store <200 drums in the space normally available for 3,000 drums.

[4] It should be noted that separating waste containers *using any scheme* will generally decrease handling frequency at the expense of increased space requirements.

Beyond the need to relocate wastes to support the 3,100 $m^3$ Project, and if RWMC Operations were to be limited to five Type II modules, the free space initially available for sorting and separation would be equivalent to <6,000 drums. The logical consequences of such a limitation impose two major penalties:

1. The number of drum movements required to achieve the 3,100 $m^3$ milestone would increase substantially because available free space is inadequate to:

- separate drums destined for characterization from drums known or suspected to be unsuitable
- separate drums by disposition (certifiable, future consideration, treatment)
- staging of payload assemblies for shipment to WIPP.

2. Other than storing boxes separately from drums, no separation by waste type would be possible without moving drums around numerous times. (The exercise is one of *moving the free space around*, while attempting to leave quantities of drums in or closer to some desirable configuration.)

## C.2 Calculations for Individual Storage Modules

### C.2.1 <u>Current Conditions</u>:

The most important question to be resolved will define the path between current conditions and the end state: How many Type II modules will the 3,100 $m^3$ Project need? Most other considerations can be resolved once this fundamental question is answered.

The accessible inventory of stored waste as of August 27, 2001 consists of the following.

**NOTE 1:** *Data obtained from Transuranic Reporting, Inventory, and Reporting Process System (TRIPS), "Building Container Count", August 27, 2001 with spot visual verification by facility walkdown on August 28, 2001 and September 10, 2001.*

**NOTE 2:** *Theoretical floor space loading factors and module utilization calculations are on pages C-8 through C-14 for the following tables.*

**NOTE 3:** *The storage lost due to segregation issues (such as, dissimilar containers, heavy drums, TSCA waste, unknowns) was assigned based on walk-down. Any row with less than 50% space left was assumed to be space lost due to segregation issues.*

**Building WMF-628**

| Container Type | Number of Containers | Current Module Utilization |
|---|---|---|
| 55-gal drums | 1291 | 0.08 |
| 83-gal drums* | 34 | 0.18 |
| Radioactive Shielded Storage Containers (RSSC) | 10 | (included with 83-gal drums) |
| Vented Overpack Cylindrical Painted Drum | 11 | 0.03 |
| Box, M-III, M-IV Bin | 4 | 0.01 |
| Box, SAND Type I | 1 | 0.01 |
| Box, Shielded Rectangular | 12 | 0.01 |
| Box, Mexican Americium | 4 | 0.03 |
| Box, TX-4 Oversize steel | 1 | 0.01 |
| **Approximate space lost due to segregation** | - | **0.07** |
| **Space utilized for payloads ready to ship (Ref. 22) and at different stages of certification (See Figures 7 & 8)** | **Varies** | **0.50** |
| **TOTAL** | | **0.93** |
| **Future Available Module Utilization** | | **0.07 ~ 0.0** |

* - Stored in Special Arrangement for Criticality Concerns (see Figure 3).

**Building WMF-629**

| Container Type | Number of Containers | Current Module Utilization |
|---|---|---|
| 55-gal drums | 1701 | 0.10 |
| 83-gal drums | 164 | 0.02 |
| Standard Waste Boxes (SWBs) | 42 | 0.08 |
| **Approximate space lost due to segregation** | - | **0.05** |
| **Planned use by 3,100m$^3$ for 26 payloads 52 pellets assuming 3 pellets per row space needed is 17 45 ft long rows (Ref. 22).** | | **0.5** |
| **TOTAL** | | **0.75** |
| **Future Available Module Utilization Module** | | **0.25** |

**Building WMF-630**

| Container Type | Number of Containers | Current Module Utilization |
|---|---|---|
| 55-gal drums | 8221 | 0.50 |
| **Approximate space lost due to segregation** | - | **0.10** |
| **TOTAL** | | **0.60** |
| **Future Available Module Utilization** | | **0.40** |

**Building WMF-631**

| Container Type | Number of Containers | Current Module Utilization |
|---|---|---|
| 55-gal drums | 7515 | 0.46 |
| 83-gal drums | 881 | 0.11 |
| Box, SAND Type 2 | 137 | 0.08 |
| **Approximate space lost due to segregation** | - | **0.12** |
| **TOTAL** | | **0.77** |
| **Future Available Module Utilization** | | **0.23** |

**Building WMF-632**

| Container Type | Number of Containers | Current Module Utilization |
|---|---|---|
| 55-gal drums | 899 | 0.06 |
| 83-gal drums | 2791 | 0.35 |
| Box, 6 drum Overpack | 16 | 0.48* |
| Box, FRP Overpack | 15 | * |
| Box, SAND Type 1 | 11 | * |
| Box, SAND Type 2 | 306 | * |
| Cakebox | 219 | * |
| Box, Fiberglass Reinforced Plywood (FRP) | 116 | * |
| Box, TX-4 Standard steel | 23 | * |
| Box, TX-4 Oversize steel | 77 | * |
| **Approximate space lost due to segregation** | - | **0.08** |
| **TOTAL** | | **0.97** |
| **Future Available Module Utilization** | | **0.03 ~ 0.0** |

* - All Boxes are combined together.

**Building WMF-633**

| Container Type | Number of Containers | Current Module Utilization |
|---|---|---|
| 55-gal drums | 1733 | 0.11 |
| 83-gal drums | 1 | 0.0 |
| Box, SAND Type 2 | 747 | 0.62* |
| Cakebox | 39 | * |
| Box, TX-4 Oversize steel | 227 | * |
| Bin, 120 cubic feet, (M-III, M-IV) | 50 | 0.17 |
| **Approximate space lost due to segregation** | **-** | **0.07** |
| **TOTAL** | | **0.97 ~ 1.0** |
| **Future Available Module Utilization** | | **0.03 ~0.0** |

* - All Boxes are combined together.

**Summary of Current Module Utilization and Future Module Availability**

| Module Number | Current Module Utilization | Future Module Availability |
|---|---|---|
| WMF-628 | 0.93 ~ 1.0 | ~0.0 |
| WMF-629 | 0.75 | 0.25 |
| WMF-630 | 0.60 | 0.40 |
| WMF-631 | 0.77 | 0.23 |
| WMF-632 | 0.97 ~ 1.0 | ~ 0.0 |
| WMF-633 | 0.97 ~ 1.0 | ~ 0.0 |
| **TOTAL** | **~ 5.12** | **~ .88** |

# C.3 Theoretical Storage Capacity calculations

## C.3.1 Available Storage Module Area (Maximum)

See Attachment B for floor plan of WMF-628, which is a Type II Storage Module. All Type II modules have the same floor plan.

The interior of each Type II Storage Module can be divided into rows or grids. A row reflects the floor space committed to the storage of a type of waste container (for example, boxes, 55-gal drums, 83-gal overpacks). The space around each row reflects the clearance and inspection/access-aisle spacing required by the Part B Permit. Hence, it is relatively simple to calculate the maximum number of drums, overpacks or boxes that a Module can hold.

Note that the basis for maximum-capacity calculations ignores such considerations as access/egress-buffer space (for example, shortened rows) near the end-doors, segregation by waste type, waste-form incompatibility issues, intended use, or radiological control procedures.

Each module can accept the following configurations at "maximum theoretical capacity:"

**Floor Storage Space Computation for a Typical Storage Module**

In this computation, WMF-628 represents the model. See Attachment B.

- 30 rows (45 ft-0 in. long x 8 ft-4 in. wide) = 30 x 45 x 8.33 = 11,246 sq ft
- 6 rows (41 ft-0 in. long x 8 ft-4 in. wide) = 6 x 41 x 8.33 = 2,049 sq ft
- 2 rows (33 ft-0 in. long x 8 ft-4 in. wide) = 2 x 33 x 8.33 = 550 sq ft
- 2 rows (25 ft-0 in. long x 8 ft-4 in. wide) = 2 x 25 x 8.33 = 417 sq ft

TOTAL Storage Space = 14,262 sq. ft.

**This configuration results in a maximum of 14,262 sq ft of storage space in a module.**

## C.3.2 55-Gal Drums (Stacked 5 High Except Last/Outside 8 Drums on Top Tier of Each Row):

The drums are handled and stored on pallets. Each row is 4 drums (1 pallet) wide and 5 drums high, except for the last or outside-most 8 drums on the top tier of each row. See Figures 1 and 10 in Appendix D. Each pallet is taken as 4 feet deep and the number of pallets in a given row is defined by the row length as noted below.

A. 30 rows (45 ft-0 in. long) of 55-gal drums; drums handled and stored on pallets. Each row is 4 drums (1 pallet) wide, 5 drums high, and 22 deep. This results in a maximum of 13,200 –(8 x 30) = 12,960 55-gal drums for the 45 ft-0 long rows.

B. 6 rows (41 ft-0 in. long) of 55-gal drums; drums handled and stored on pallets. Each row is 4 drums (1 pallet) wide, 5 drums high, and 20 deep. This results in a maximum of

C. 2,400 - (8 x 6) = 2,352 55-gal drums for the 41 ft-0 in. long rows.

D. 2 rows (33 ft-0 in. long) of 55-gal drums; drums handled and stored on pallets. Each row is 4 drums (1 pallet) wide, 5 drums high, and 16 deep. This results in a maximum of 640 – (8 x 2) = 624 55-gal drums for the 33 ft-0 in. long rows.

E. 2 rows (25 ft-0 in. long) of 55-gal drums; drums handled and stored on pallets. Each row is 4 drums (1 pallet) wide, 5 drums high, and 12 deep. This results in a maximum of 480 – (8 x 2) = 464 55-gal drums for the 25 ft-0 in. long rows.

Thus, the total capacity module for 55-gal drums in a dense-pack configuration = 12,960 + 2,352 + 624 + 464 = 16,400 drums per building.

**This configuration results in a maximum of 16,400 55-gal drums per module.**

### C.3.3 83-Gal Overpacks (Stacked 4 High Except Last/ 6 Drums on Top Tier of Each Row):

The overpacks are handled and stored on pallets. Each row is 3 overpacks (1 pallet) wide and 4 overpacks high, except for the last or outside-most 6 drums on the top tier of each row. (See Figure 11 in Appendix D.) Each pallet is taken as 4 feet deep and the number of pallets in a given row is defined by the row length as noted below.

A. 30 rows (45 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 3 overpacks wide, 4 overpacks high, and 18 deep. This results in a maximum of 3960 – (6 x 30) = 6300 overpacks for the 30 longest rows.

B. 6 rows (41 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 3 overpacks wide, 4 overpacks high, and 16 deep. This results in a maximum of 720 – (6 x 6) = 1116 overpacks for the 41 ft-0 in. long rows.

C. 2 rows (33 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 3 overpacks wide, 4 overpacks high, and 13 deep. This results in a maximum of 192 – (6 x 2) = 300 overpacks for the 33 ft 0 in. long rows.

D. 2 rows (25 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 3 overpacks wide, 4 overpacks high, and 10 deep. This results in a maximum of 144 – (6 x 2) = 228 overpacks for the 25 ft-0 in. long rows.

Thus, the total capacity for 83-gal overpacks in dense-pack = 6300 + 1116 + 300 + 228 = 7944 83-gal overpacks per module.

**This configuration results in a maximum of 7944 83-gal overpacks per module.**

In WMF-628 there are currently 83-gal overpacks stored to maintain spacing necessary to alleviate criticality issues (see Figure 3 in Appendix D) (Ref. 22) and 10 Radioactive Shielded Storage Containers (RSSC's) placed in a dedicated row. The overpacks are located such that they monopolize the following rows: NN, NO, NP, NQ, NR, NS. Row NT is allocated for the RSSC's. (See Figure 2.) All rows are 8 ft 4in. wide. Rows NN, NO, NP, NQ and NR are 45 ft-0 in. long; Row NS is 41 ft-0 in. long and Row NT is 33 ft-0 in. long. Based upon the above methodology, this arrangement occupies an area that utilizes the equivalent space allotted for:

(3 x 4 x 11 x 5) - (6 x 5) = 660 - 30 = 630

(3 x 4 x 10 x 1) - (6 x 1) = 120 - 6 = 114

(3 x 4 x 8 x 1) - (6 x 1) = 96 - 6 = 90

or the equivalent of 630 + 114 + 90 = 834 83-gal overpacks.

### C.3.4 RH Waste Overpacks Painted or RSSC (Stacked 1 High):

The overpacks are handled and stored on pallets (see Figure 2). Each row is 2 overpacks (1 pallet) wide as shown in Figure 2 or Figure 4 in Appendix D except that the row is only 1 overpack high. Each pallet is taken as 4 ft deep and the number of pallets in a given row is defined by the row length as noted below.

A. 30 rows (45 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 2 overpacks wide, 1 overpacks high, and 11 deep. This results in a maximum of 660 overpacks for the 30 longest rows.

B. 6 rows (41 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 2 overpacks wide, 1 overpack high, and 10 deep. This results in a maximum of 120 overpacks for the 41 ft-0 in. long rows.

C. 2 rows (33 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 2 overpacks wide, 1 overpack high, and 8 deep. This results in a maximum of 32 overpacks for the 33 ft-0 in. long rows.

D. 2 rows (25 ft-0 in. long) of overpacks handled and stored on pallets. Each row is 2 overpacks wide, 1 overpack high, and 6 deep. This results in a maximum of 24 overpacks for the 25 ft-0 in. long rows.

Thus, the total capacity for 83-gal overpacks in single level dense-pack =
660 + 120 + 32 + 24 = 836 RH overpacks per module.

**This configuration results in a maximum of 836 RH overpacks per module in dense-pack single layer storage.**

### C.3.5 Boxes:

Some of the boxes are handled and stored on pallets. Others are handled and stored without pallets. For this calculation, each row is assumed to be 1 box wide and 4 boxes high. Each box or pallet is assumed to be approximately 4 ft deep and the number of boxes in a given row is defined by the row length as noted below. (See Figures 12, 13, and 15 in Appendix D.)

All rows lack the back-most top tier of boxes similar to how the drums and overpacks are stored as shown in Figure 15 in Appendix D. The boxes are assumed (for purposes of this calculation) to be 4 ft deep (as noted above), 8 ft wide and 4 ft high.

A. 30 rows (45 ft-0 in. long) of boxes. Each row is 1 box wide, 4 boxes high and 10 deep, plus 3 boxes high and 1 deep. This results in a maximum of (40 + 3) x 30 = 1290 boxes for the 30 longest rows.

B. 6 rows (41 ft-0 in. long) of boxes. Each row is 1 box wide, 4 boxes high, and 9 deep, plus 3 boxes high and 1 deep. This results in a maximum of (36 + 3) x 6 = 234 boxes for the 41 ft-0 in. long rows.

C. 2 rows (33 ft-0 in. long) of boxes. Each row is 1 box wide, 4 boxes high, and 7 deep, plus 3 boxes high and 1 deep. This results in a maximum of (28 + 3) x 2 = 62 boxes for the 33 ft-0 in. long rows.

D. 2 rows (25 ft-0 in. long) of boxes. Each row is 1 box wide, 4 boxes high, and 5 deep, plus 3 boxes high and 1 deep. This results in a maximum of (20 + 3) x 2 = 46 boxes for the 25 ft-0 in. long rows.

Thus, the total capacity for boxes in dense-pack =
1290 + 234 + 62 + 46 = 1,632 boxes per module.

**This configuration results in a maximum of 1,632 boxes per module.**[5]

### C.3.6 Bins:

The 54 bins are stored on only one level due to their current storage configurations (See Figures 14 and 16 in Appendix D) and the presence of lid hardware. They are approximately 4 ft x 4 ft x 8 ft in size and are assumed to have a depth space allocation of approximately 5 ft-0 in. or 6 ft-0 in. per bin.

Thus, applying the methodology used for the 55-gal drums and the 83-gal overpacks, the maximum number of bins in a module is computed:

A. 30 rows (45 ft-0 in. long) of bins. Each row is 1 bin wide, 1 bin high, and 8 deep. This results in a maximum of 240 bins for the 30 longest rows.

B. 6 rows (41 ft-0 in. long) of bins. Each row is 1 bin wide, 1 bin high, and 7 deep. This results in a maximum of 42 bins for the 41 ft-0 in. long rows.

C. 2 rows (33 ft-0 long) of bins. Each row is 1 bin wide, 1 bin high, and 6 deep. This results in a maximum of 12 bins for the 33 ft-0 in. long rows.

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[5] Unlike the 55-gallon drums and the 83-gal drums, boxes come in a variety of sizes and shapes. Hence, the “nominal” configuration of box rows assumes an “average” box. Some boxes may allow configurations up to 11 boxes deep or 4 tiers high

D. 2 rows (25 ft-0 in. long) of bins. Each row is 1 bin wide, 1 bin high, and 4 deep. This results in a maximum of 8 bins for the 25 ft-0 in. long rows.

Thus, the total capacity for bins based upon the above assumptions =
240 + 42+ 12 + 8 = 302 bins per module.

This configuration results in a maximum of 302 bins per module.
Minimum number of modules required for bins = 54 ÷ 302 = 0.18 module

### C.3.7 Vented Overpack Cylindrical Painted Drums (VOCPD)

The VOCPDs are currently located in Row SP in WMF-628. Row SP is 45 ft-0 in. long and 8 ft-4 in. wide. Assume, conservatively, the full area of this row is allocated: (45 x 8.33) = 375 sq ft. (See Figure 4 in Appendix D.)

Number of modules required for Vented Overpack Cylindrical Painted Drums =

375 ÷ 14,262 = 0.03 module

### C.3.8 Mexican Americium Boxes

The Mexican Americium boxes are currently located in Row SL in WMF-628. Row SL is 45 ft-0 long and 8 ft-4 in. wide. Assume, conservatively, the full area of this row is allocated: (45 x 8.33) = 375 sq ft. (See Figure 6 in Appendix D.)

Number of modules required for Mexican Americium boxes =

375 ÷ 14,262 = 0.03 module

### C.3.9 Shielded Rectangular Boxes

The shielded rectangular boxes are currently located in Rows SQ and SS in WMF-628. (See Figure 5 in Appendix D.) Row SS is 45 ft-0 in. long and 8 ft-4 in. wide. Row SQ is 41 ft-0 in. long and 8 ft-4 in. wide. Assume, conservatively, the full area of these rows is allocated:

(45 x 8.33) + (41 x 8.33) = 375 + 342 = 717 sq ft

Number of modules required for shielded rectangular boxes =

717 ÷ 14,262 = 0.05 module

### C.3.10 Standard Waste Boxes (SWBs)

The SWBs are currently located in Rows NQ, NR, and NS in WMF-629. (See Figure 9 in Appendix D.) Rows NQ and NR are 45 ft-0 in. long and 8 ft-4 in. wide. Row NS is 41 ft-0 in. long and 8 ft-4 in. wide. Assume, conservatively, the full area of the rows is allocated: 2 x (45 x 8.33) + (41 x 8.33) =

750 + 342 = 1092 sq ft

Number of modules required for SWBs = 1,092 ÷ 14,262 = 0.08 module

### C.3.11 Remaining Boxes

Minimum number of modules required for the remaining boxes (SAND Types 1 and 2, FRP, FRP overpack, 6 drum overpacks, TX-4 standard and oversize steel, and cakeboxes) lumped together =

1,935 ÷ 1,632 = 1.19 modules

## C.4 Space Utilization For WMF-628

The following calculations are for waste volumes that may be rejected by BNFL or if treated will be returned to BBWI for disposition.

A. Waste volumes that may need to be stored and characterized by BBWI include BNFL untreatable waste (516 $m^3$): 73 $m^3$of U-233 non-irradiated fuel waste, 52 $m^3$ of RH U-233 waste, 220 $m^3$ suspect RH Waste from Rocky Flats, 87 $m^3$ of high fissile waste and 84 $m^3$ of RH-TRU waste. There are also 42 $m^3$ of non-defense generated waste, which will be processed by AMWTF, but does not have a disposal path. Thus, for computational purposes, a total volume of 558 $m^3$ (516 + 42) of waste is addressed as follows (Ref. 16).

After BNFL retrieves waste and no path forward is available the maximum storage space needed is as follows.

| Waste Type & Cubic Meters | Containers (See Note 1) | Type of Storage | Module Basis (see below) | Module Requirement |
|---|---|---|---|---|
| U-233 Rods &Pellets 73 | 351 | Single level VOCPD | (See Note 4) | 0.42 |
| RH U-233 52 | 250 | Single level VOCPD | (See Note 4) | 0.30 |
| Suspect RH 220 | 1057 | 83-gal stackable | (See Note 5) | 0.13 |
| High Fissile 87 | 418 | One level CCA (assume 4.5 ft c/c) | (See Note 6) | 1.67 |
| RH TRU 84 | 650 | Single level VOCPD | (See Note 4) | 0.78 |
| Non Defense TRU (42) use 36 (See Note 2) | 173 | Single level VOCPD | (See Note 1) | 0.24 |
| Total | 2,899 | | | 3.54 |

**NOTE 1:** *All containers are assumed to be 55 gal (0.208m3) unless noted.*

**NOTE 2:** *Non-defense TRU includes 6 cubic meters of Mexican Americium which has been considered separately in this report. Thus, the calculation basis used is 36 cubic meters.*

**NOTE 3:** *The total number of RH TRU containers in ILTSF vaults (611 30 gal and 19 55-gal).*

**NOTE 4:** *Module basis is maximum of 836 VOCPD RH overpacks per module, calculated above.*

**NOTE 5:** *Module basis is maximum of 7,944 83-gal overpacks in a dense pack stackable arrangement, also calculated above.*

**NOTE 6:** *Module basis is based on the assumption that the single level CCA storage requires 4.5 ft center-to-center spacing. Currently WMF-628 has a CCA area that utilizes approximately 0.16 module, calculated above. There are 34 containers with room for about 6 more containers in that area for a total of 40. Thus, by ratio: (418 x 0.16) ÷ 40 = 1.67 modules.*

B. ER forecast by FY 2007 for approximately 1,000 55-gal drums is 1000 ÷ 16,400 = 0.06 storage modules based on dense pack configuration where a maximum of 16,400 55-gal drums may be stored in one module.

C. If the TRU waste BBWI is responsible for is received/retrieved in accordance with the Life-Cycle Planning as well as TRU waste disposition plan, the amount of storage space needed is show in the table below. These storage area requirements are based upon the assumption that a suspect RH TRU container is a 83-gal overpack that is stored in a stacked dense-pack configuration and 7,944 containers can be stored in module, while the RH container is shielded overpack and only 836 containers can be stored per module.

**RH TRU Waste Disposition Process Planning Forecasts**

| FY | RH Containers | RH U-233 | Suspect RH | Total containers | Modules* |
|---|---|---|---|---|---|
| **2002** | 25 | | 0 | 25 | 0.03 |
| **2003** | 25 | | 0 | 25 | 0.03 |
| **2004** | 55 | | 0 | 55 | 0.07 |
| **2005** | 70 | | 69 | 139 | 0.09 |
| **2006** | 85 | 50 | 138 | 273 | 0.18 |
| **2007** | 100 | 100 | 207 | 407 | 0.1 |
| **2008** | 120 | 150 | 271 | 541 | 0.36 |
| **2009** | 130 | 200 | 345 | 675 | 0.44 |
| **2010** | 70 | 250 | 399 | 719 | 0.43 |
| **2011** | 70 | 250 | 322 | 642 | 0.42 |
| **2012** | 45 | 250 | 241 | 536 | 0.38 |
| **2013** | 20 | 250 | 160 | 430 | 0.34 |
| **2014** | 0 | 250 | 55 | 305 | 0.31 |
| **2015** | | 125 | | 125 | 0.15 |
| **2016** | 0 | 125 | 0 | 0 | 0.15 |

(Based upon Reference 10 & 15)

*Modules ={ (No. of RH containers + No. RH-U233 containers) ÷ 836 + No. of suspect RH containers ÷ 7,944}

If the containers are processed as planned, the RH TRU (RH+RH U233+suspect RH) waste will need a maximum of 0. 44 module as a storage space compared to 1.21 module if no path forward was available for these three waste streams.

# APPENDIX D

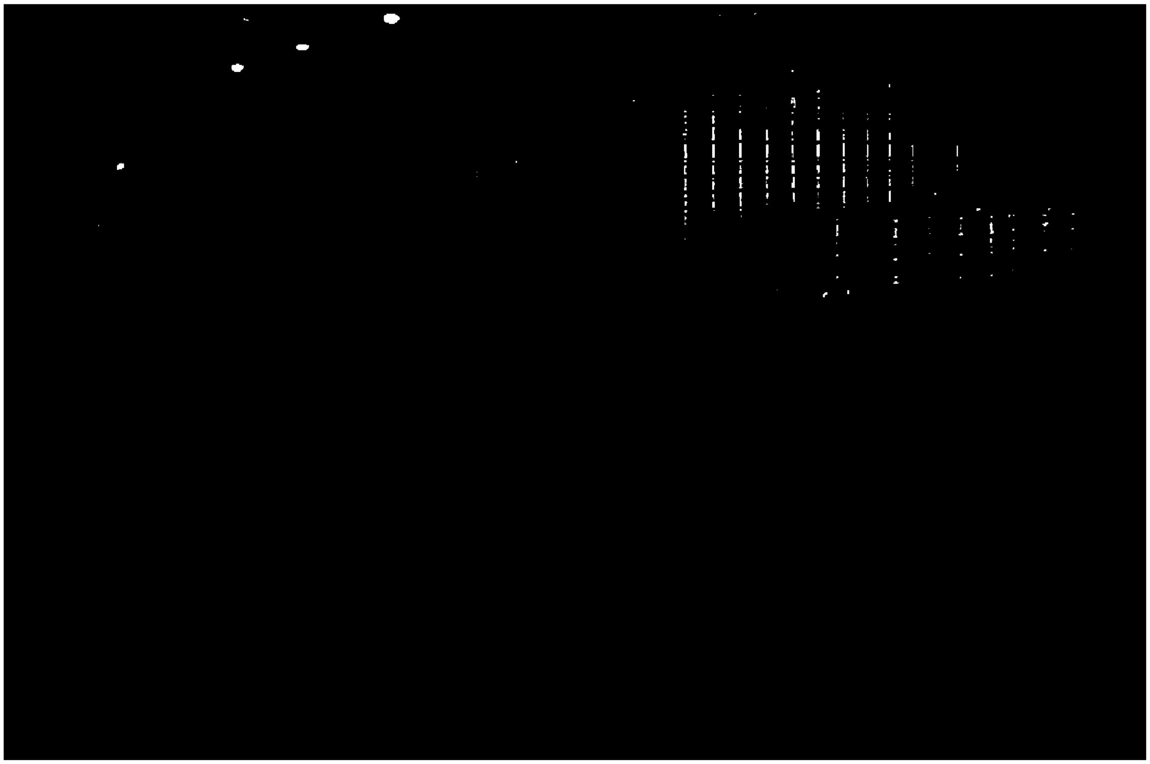

Figure 1. Interior of WMF-628, looking east.

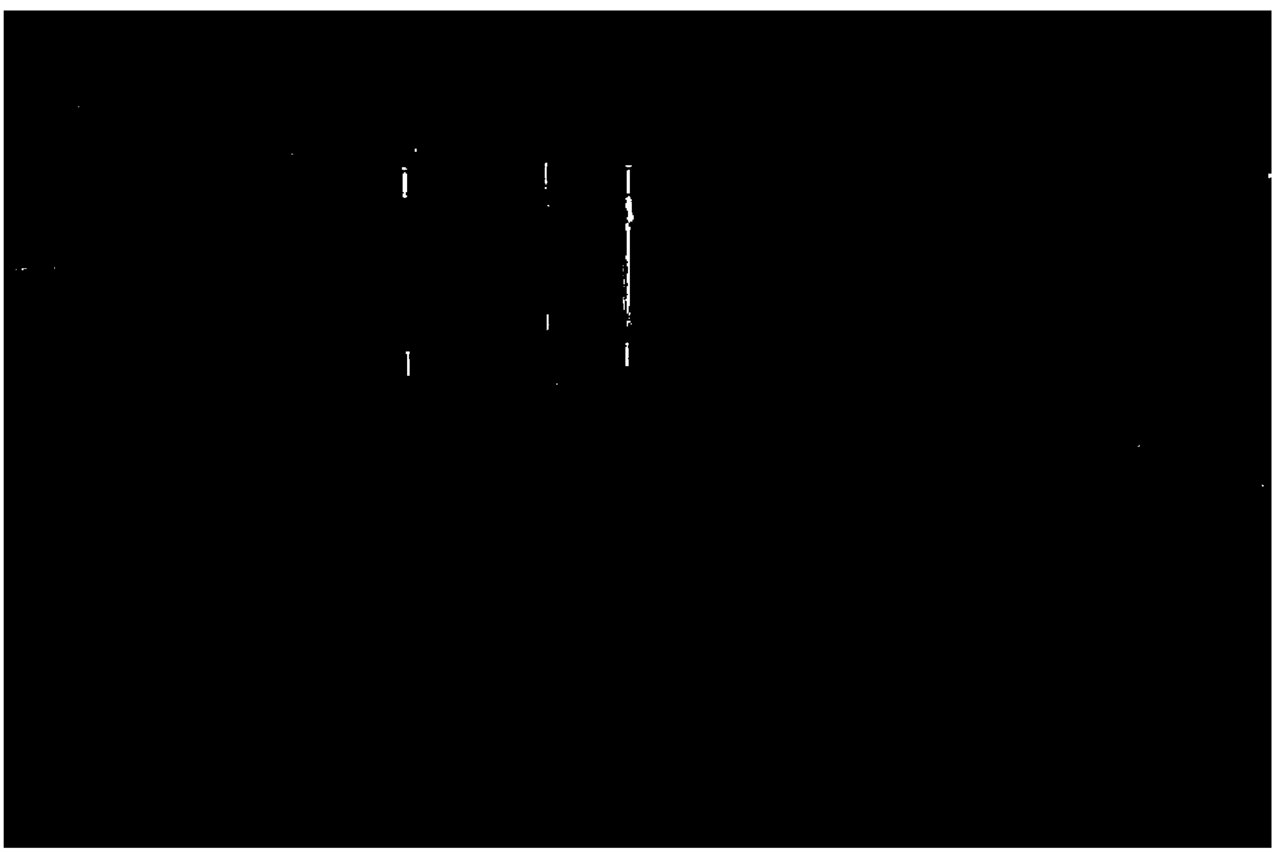

Figure 2. Radioactive shielded storage containers in WMF-628.

Figure 3. Spacing of drums for criticality concerns in WMF-628.

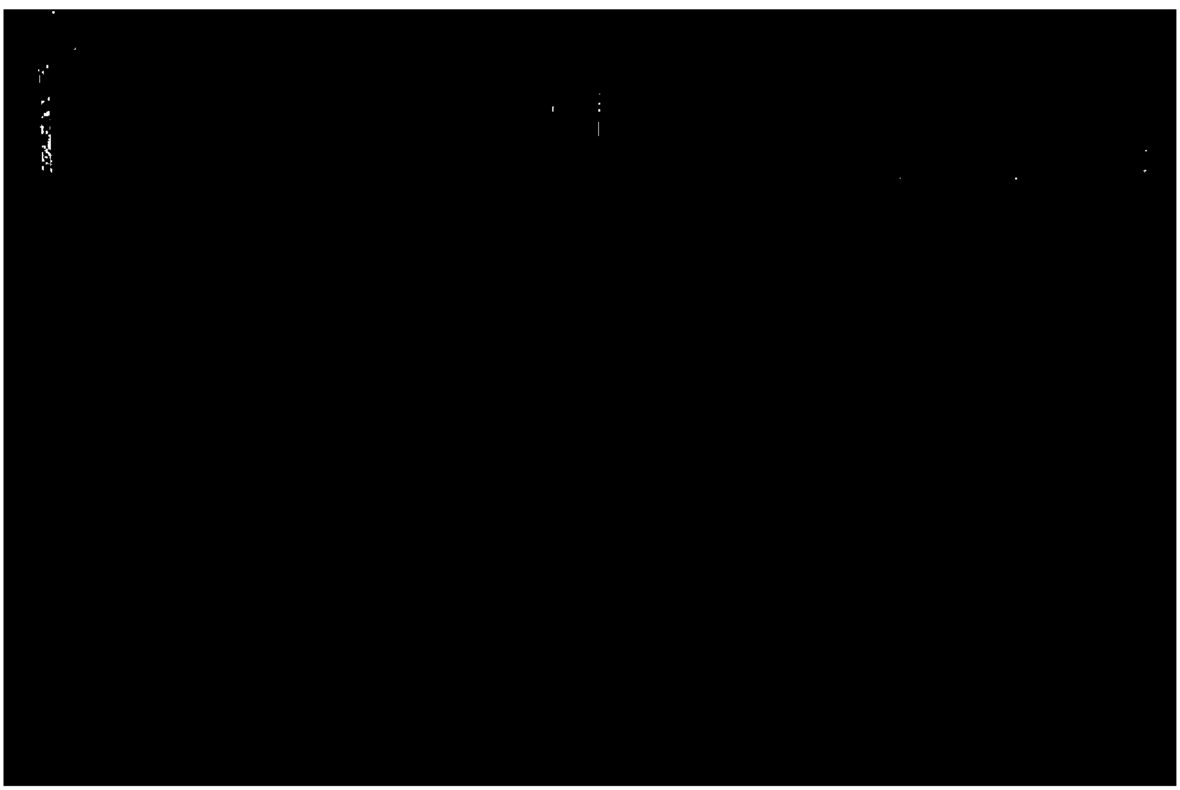

Figure 4. Vented overpack cylindrical painted drums in WMF-628.

Figure 5. Shielded rectangular boxes in WMF-628.

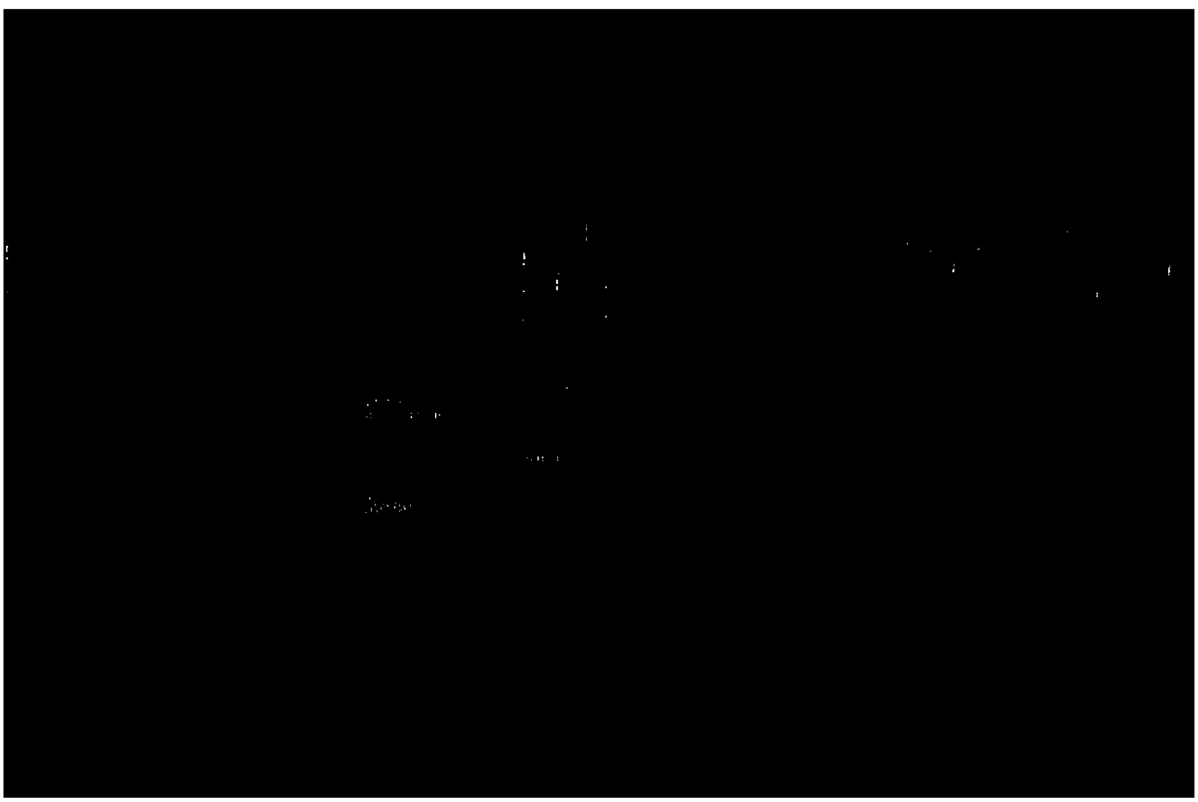

Figure 6. Mexican Americum boxes, Row SL in WMF-628.

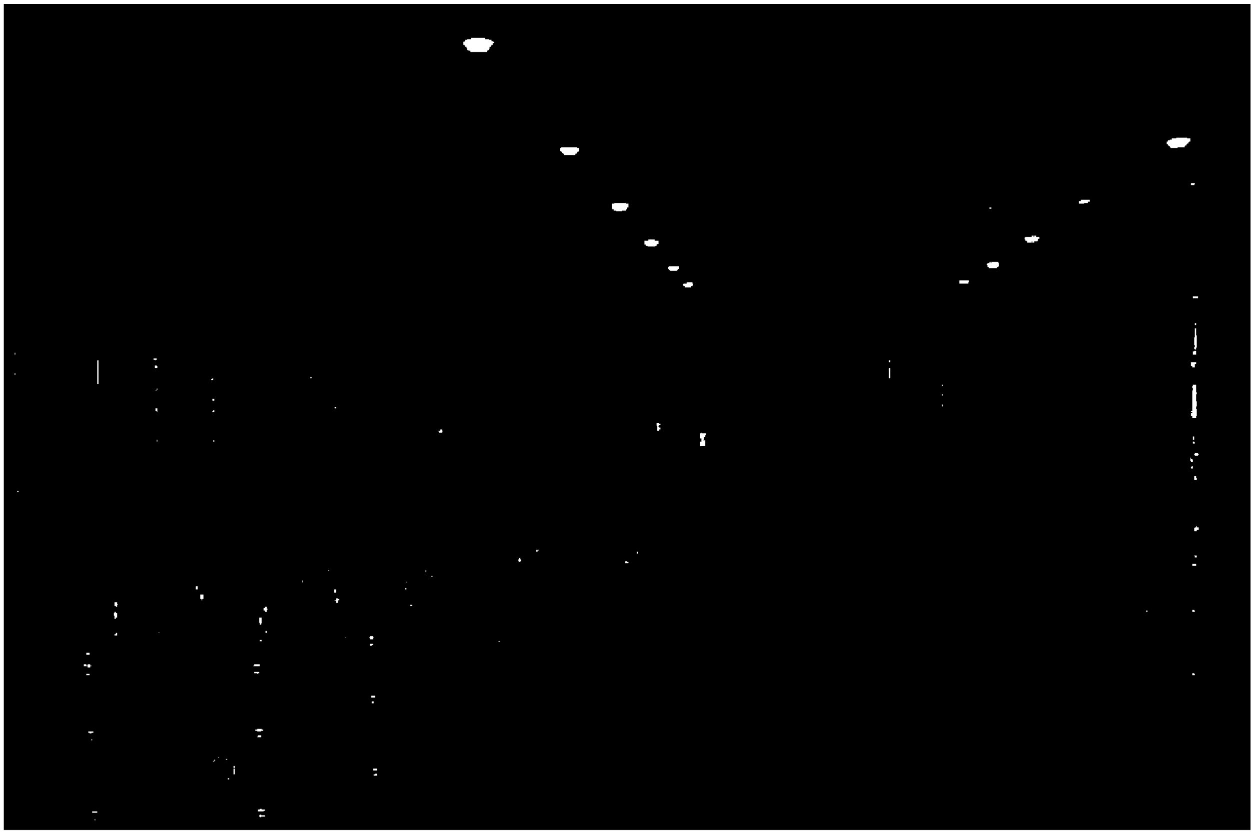

Figure 7. Pre-staged containers, rows NA-NJ, in WMF-628.

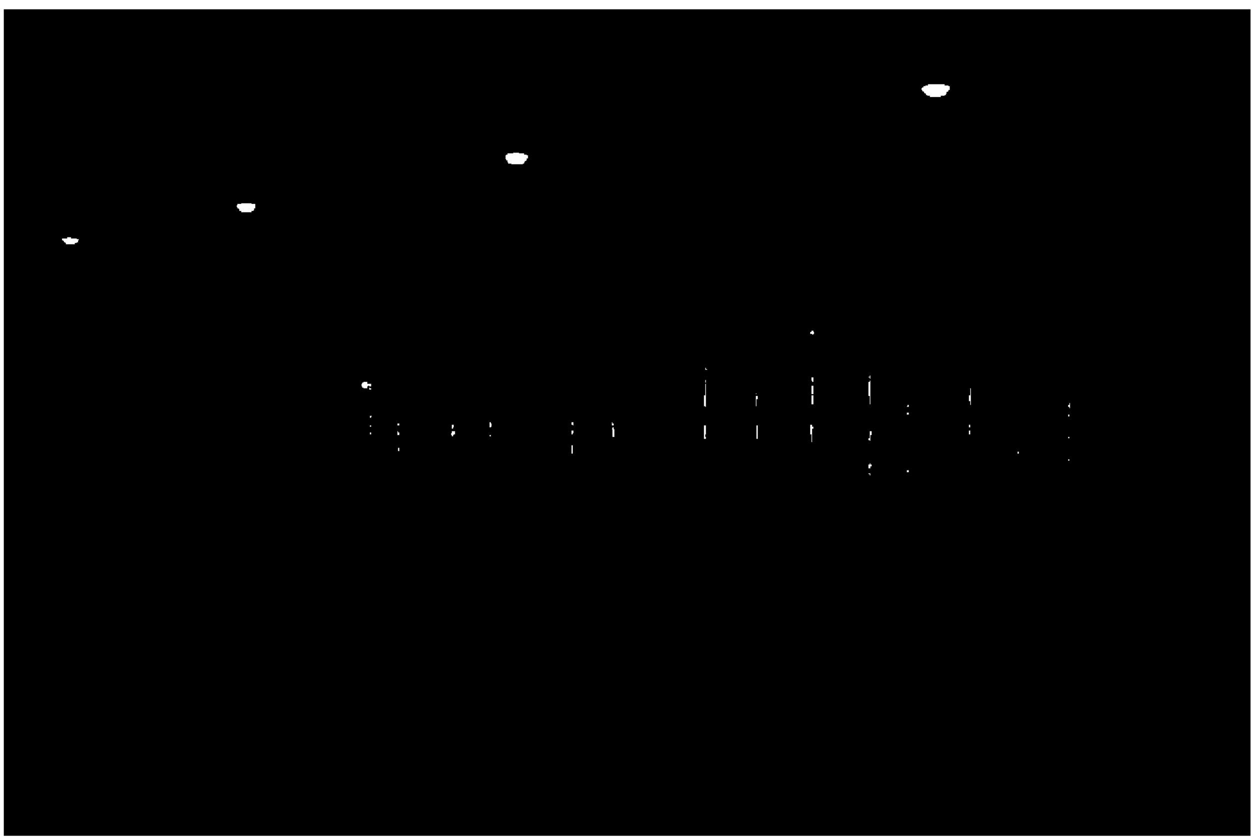

Figure 8. Pre-staged shipping containers, rows SA-SJ, in WMF-628

Figure 9. Standard waste boxes, row NS, in WMF-629.

Figure 10. 55-gal drum storage in WMF-630.

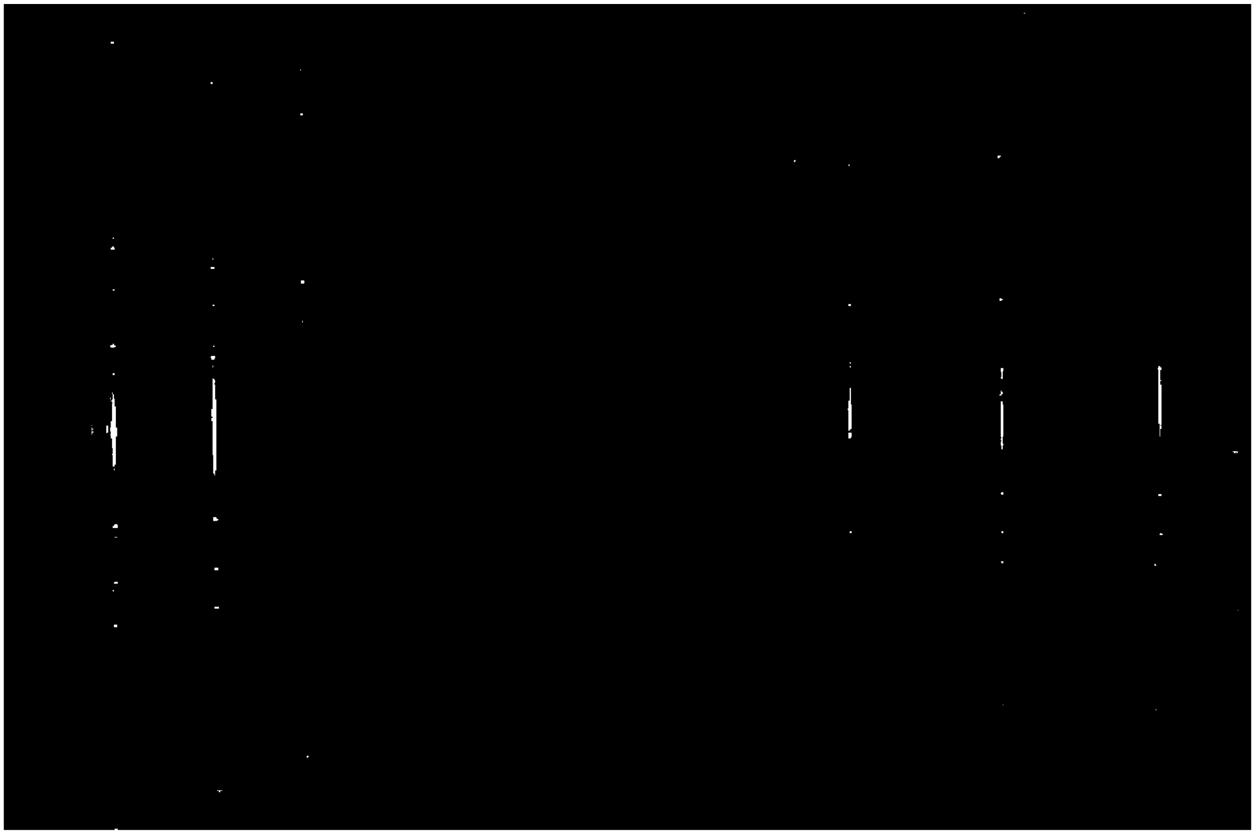

Figure 11. 83-gal overpack storage in WMF-631.

Figure 12. Interior of WMF-632, looking west.

Figure 13. Boxes, including FRP boxes in WMF-632.

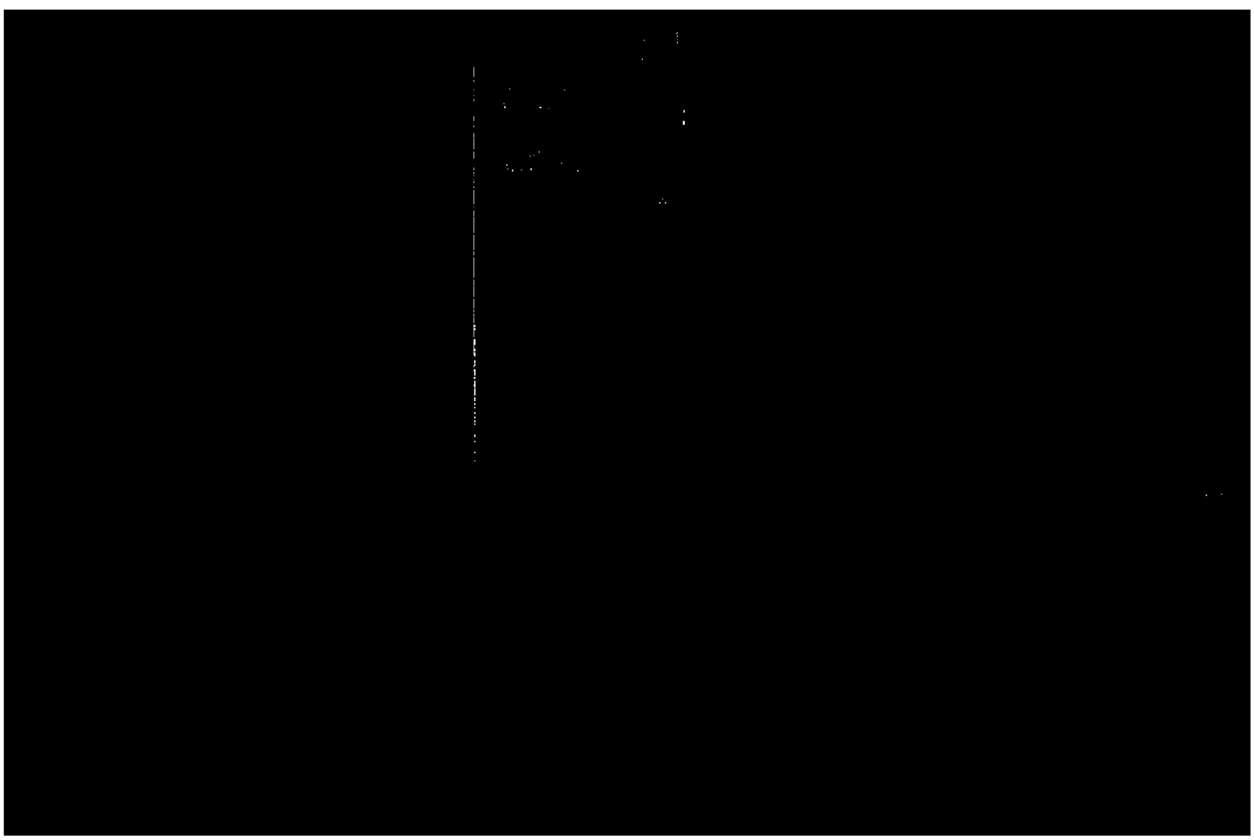

Figure 14. Bins, south side of WMF-633.

Figure 15. Boxes, south side of WMF-633.

Figure 16. Bin and boxes, south side of WMF-633.

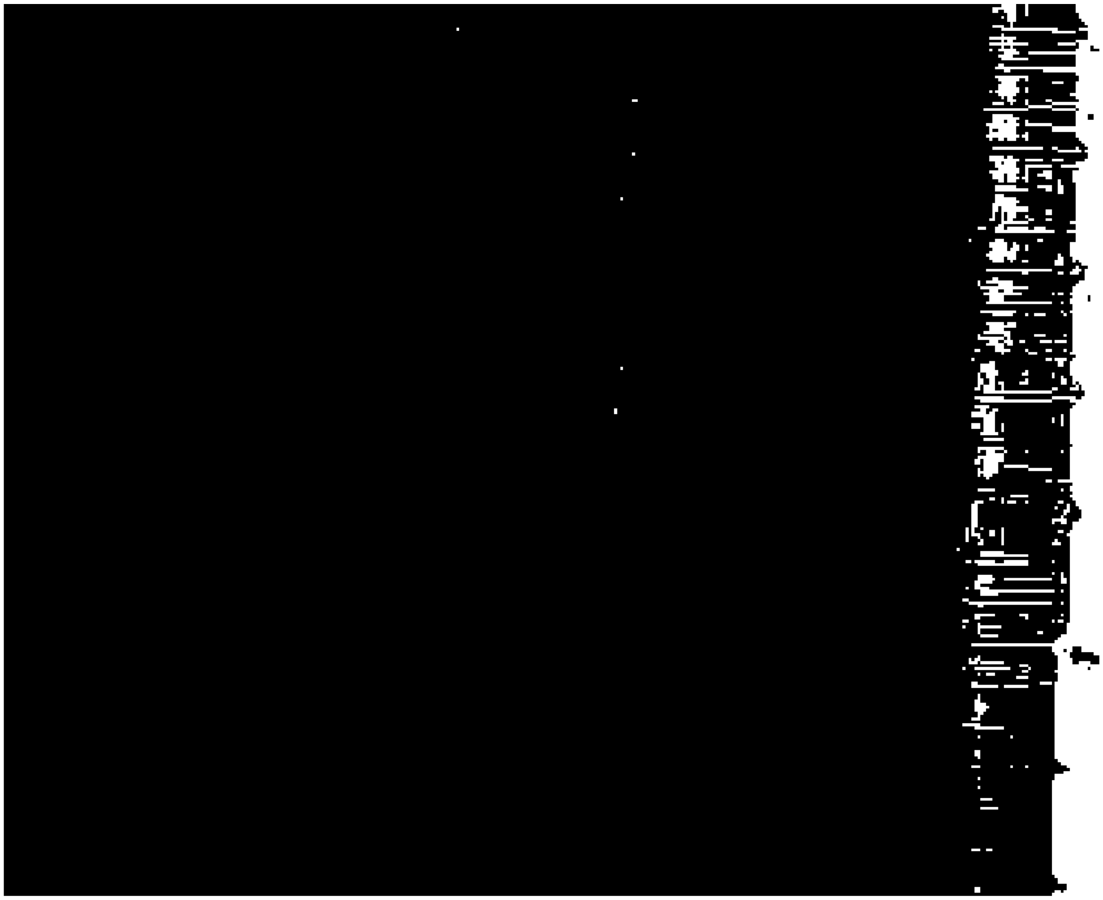

Figure 17. Back row of boxes, south side WMF-632.